March 6, 1968

To the Graduate Council:

I am submitting herewith a thesis written by John L. Kyle entitled "An Analysis of November Soybean Futures Prices." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

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Major Professor

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Vice President for
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AN ANALYSIS OF NOVEMBER SOYBEAN FUTURES PRICES

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

---

by

John L. Kyle

June 1968

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CHAPTER I

INTRODUCTION

The soybean has been the object of widespread interest in recent years for its growing importance in the agricultural economy. The farm production of soybeans in the United States has increased over 180 percent in sixteen years, from 299 million bushels in 1950 to 844 million bushels in 1965.[1] Much of this phenomenal expansion is due to the increased demand for fats and oils initially brought about by World War II, the acreage restrictions placed on the production of cotton, corn, and wheat, and the development of soybean varieties that can be grown in virtually all parts of the country.[2] Concurrent with increasing production has been the shift of soybean production as a forage crop and for soil enrichment purposes to its present position as the second most important cash crop of the agricultural economy.[3] The value of the soybean crop has surpassed both cotton and tobacco and is second only to corn in cash income to farmers.

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[1]Economic Research Service, United States Fats and Oils Statistics, 1909-1965, United States Department of Agriculture, Statistical Bulletin No. 376 (Washington, D. C.: Government Printing Office, August, 1966), p. 70.

[2]Ray A. Goldberg, The Soybean Industry (Minneapolis: The University of Minnesota Press, 1952), pp. 8-9.

[3]United States Department of Agriculture, Agricultural Statistics, 1967 (Washington, D. C.: Government Printing Office, 1967), p. 536.

The economic importance of the soybean crop is widespread. Not only producers, but merchants, processors, exporters, and ultimately consumers as well, are affected by a market of this magnitude. The profitability of businesses depends upon the size and quality of the soybean crop, while consumers purchase a number of soybean derived products. A large or expanding market includes price risks to all parties arising primarily from the time factor involved. Any commodity, however durable, that is produced and held for later sale or for processing in future months, faces the inevitable risk of unfavorable price change during the time that it is held. Futures trading provides an opportunity to shift or minimize the risk of unfavorable price change.

In brief, futures trading evolved gradually between 1850 and 1870 as Chicago became the transportation hub of the rich, productive farmlands comprising the Midwest. Its location on the shore of Lake Michigan, the Illinois-Michigan canal linking the Illinois River and Lake Michigan, and its being the center for many railroads, made it a ready market for midwestern grain and livestock and a terminal for shipment to the East.[4]

Grain production and trade expanded, but the seasonality of production, limited storage and shipping facilities, and reduced transportation during the Winter months were reflected in drastic price movements.[5]

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[4]Department of Public Information and Education, The Marketplace (Chicago: Chicago Board of Trade), p. 24.

[5]Ibid.

Grain merchants undertook to shift or at least minimize the risk of price change by the use of "to arrive" contracts. The "to arrive" contracts provided for immediate transfer of title and establishment of price, and extended the delivery date from a few days to several months.[6] From this practice evolved the concepts of commodity exchanges and futures contracts.

I. THE ECONOMIC FUNCTIONS OF A COMMODITY EXCHANGE[7]

A commodity exchange serves a number of functions which provide possible benefits to producer, processor, consumer, and others alike. Were the functions not beneficial, exchanges would not have continued as an integral part of the grain marketing system.

Assembling and Publicizing Information

A general observation of the futures market[8] is that cash and futures prices tend to move in the same direction.[9] This tendency holds widespread interest and futures prices, therefore, receive immediate and

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[6]Henry H. Bakken, Theory of Markets and Marketing (Madison, Wisconsin: Mimir Publishers, Inc., 1953), pp. 103-104.

[7]This section is drawn from the presentation of Julis B. Baer and George P. Woodruff, Commodity Exchanges (New York: Harper and Brothers Publishers, 1929), pp. 209-226.

[8]The terms "futures markets" and "commodity exchanges" are herein used interchangeably.

[9]Ross Milner, How Prices Are Determined, The Ohio Agricultural Extension Service Bulletin No. 437 (Columbus: The Ohio State University, June, 1963), pp. 16-17.

extensive publicity. Considerable market information is made available about such factors as production, utilization, existing supplies and shipments, More information is assembled and disseminated from a commodity exchange than could otherwise be possible for numerous "spot" markets. Such information enables more to be known about trading and the factors that affect it, therefore assuring a more competitive market. In turn, a competitive market increasingly assures fair treatment of everyone and prices free of manipulation.

Regulation and Standardization

Regulation of futures trading is shared by the commodity exchange and the Commodity Exchange Authority, an agency of the United States Department of Agriculture. Close supervision over speculation is maintained along with regulations to prevent the possibility of price manipulation and "cornering the market."

Standards of weighing, inspection, and grading established or adopted by the exchange insure orderly dealing in the futures market and provide for a dependable relationship between the futures and cash markets.

Financing

The financing of inventories accounts for a substantial proportion of marketing costs. The exchange provides a continuous market, and the ready transferability of contracts provides the commodity with a high degree of liquidity. Liquidity as seen by the banker is a safeguard, and therefore is an encouragement to larger loans and/or lower interest

rates. Readily available financing enables merchants and manufacturers to operate profitably on smaller margins and thereby pass the product on to the consumer at a lower price.

Insurance

The exchange provides a broad and continuous market. Anyone able to meet the original and variation margin requirements may, through an exchange member, trade in the futures market. The continuity of the market provides ease of entry and exit as is represented by the small percentage of contracts that are not eventually offset. Occasionally businesses find it advantageous to make or accept delivery.

As indicated earlier, there is a tendency for cash and futures prices to move in the same direction. Advances or declines in the cash price tend to be paralleled by like movements in the prices of the futures contracts and vice versa.[10] The spread or difference between the cash and futures prices for a given commodity on a specified market is called the basis. The maintenance or continuation of the basis is the foundation of hedging.

Hedging represents perhaps the most important advantage derived from futures trading. To hedge means to take a position in the futures market equal in quantity and opposite in position to the already existing cash market position. Suppose a processor has hedged an inventory

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[10]Baer and Woodruff, op. cit., p. 89.

by selling futures contracts. If the cash price moves down, a loss has been incurred on the actual commodity. However, the tendency for cash and futures prices to move in the same direction means the profit on the futures market would approximately offset the loss on the cash market. Inversely, a rise in the cash market would have provided a profit on the actual commodity, while an approximately equal loss would have occurred on the futures market. In either case, there would be a loss in one market compensated for by a profit in the other. The net effect is to keep the value of the inventory constant at current market prices without risking a large loss. Though not perfect, the hedge is widely adaptable and is recognized as the most important of the functions provided by the exchange.

Pricing

Prices reflect the balance between the many factors that constitute supply and demand, both current and in the foreseeable future. As these factors change or come into view, the price equates supply with demand. Continuous price changes indicate that new factors are constantly appearing and in need of evaluation, and existing factors are in need of re-evaluation.

Prices of seasonally produced commodities, such as the grains, are speculative. It is desirable that the supply harvested during a fairly short period of time be made to last until the next year's harvest, but that it be utilized to the extent that there is a very small carry-

over into the next crop year. Usually, provided there are no artificial hindrances, market prices effectively accomplish the necessary job of rationing the crop.

The commodity exchange, through its extensive and immediate reporting of price as part of the informative function, helps keep prices in alignment with other markets throughout the world. For commodities of worldwide demand, not protected by government policy, the prices in various markets should differ only by such costs as transportation, handling, and insurance. The continuous price information available at the exchange provides an immediate means of determining when prices in different markets are out of alignment. Buying in the cheaper market while concurrently selling in the higher one soon brings the prices of the two markets into more realistic balance.

An important benefit of a futures market is that it should provide greater price stability than would exist in its absence. The merits of futures trading with regard to price stability have been and continue to be widely argued with no final answer. One fact can not be disregarded, however, the price of grain at harvest is higher with the existence of futures trading than without it.[11]

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[11]Thomas A. Hieronymus, Uses of Grain Futures Markets in the Farm Business, University of Illinois Agricultural Experiment Station Bulletin No. 696 (Urbana: University of Illinois, September, 1963), p. 21.

II. COMMODITY EXCHANGE FUNCTIONS PARALLEL CONDITIONS OF PERFECT COMPETITION

The commodity exchange is an integral part of the free market system. An important parallel exists between the functions of a commodity exchange and the four conditions of perfect competition.

The first condition necessary for the existence of perfect competition is that each buyer and seller must be unable by himself to influence the price of whatever he buys or sells. Both the futures market and the Commodity Exchange Authority supervise and regulate trading on the exchange in order to maintain a free market and prevent price manipulation.

A second requirement which must be met in order to insure perfect competition is that the commodity must be homogeneous or standardized. There can be no important differences within the commodity such that a separate demand might be established. Agricultural commodities traded on commodity exchanges are largely homogeneous and are further standardized by the exchange.

That no artificial restrictions be placed upon supply, demand, and prices of the commodity, is the third condition. There should be no price fixing or administering, supply restricting, or demand control by government, producer associations, or other private agencies. This condition is for the most part, though not fully, met by the exchange. There exists government price support for specified commodities and price fluctuation restrictions imposed by the exchange.

The fourth condition necessary for perfect competition is that buyers and sellers possess complete knowledge of the supply and demand factors. Though this condition is not fully met and as a practical matter may never be, it is more nearly approached through the assembling and immediate publicizing of market information by commodity exchanges than otherwise possible.

It is evident from the above discussion that the conditions necessary for perfect competition are reflected in the functions of the commodity exchange.

III. RELIABILITY OF FUTURES PRICES

Much criticism was directed toward the futures markets in their early years of development, specifically, that their existence "caused" greater fluctuations in price than would otherwise have occurred. Furthermore, the idea of proposing a price at a given time in the future was not in agreement with the ethical business standards of the time, or so some interested parties would have liked to have the public believe, Futures traders were periodically accused of price manipulation for their own benefit.

Research conducted by Holbrook Working and others has led to the refutation of such earlier unfounded criticisms.[12] Evidence has been accumulated in support of the expanding view that futures markets, rather

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[12]Holbrook Working, "New Concepts Concerning Futures Markets and Prices," The American Economic Review, LII (June, 1962), 447.

than increasing price movements, actually exert a tendency of stabilizing prices, thus reducing erratic price movement.

Another widely held view supported by research is that on the basis of information available at any given time concerning present and expected future supply and demand, futures prices to tend to be highly reliable estimates of price expectations. Also, futures price changes are largely market responses to changes in information regarding supply-demand prospects.

IV. OBJECTIVES OF THE STUDY

The importance of the soybean crop is reflected in the dependence of many businesses upon its size and quality and of consumers who prefer a stable supply of products at stable prices. A more accurate knowledge of price could provide for improved long-range planning and its benefits for both businessman and consumer.

To identify the significant factors used in predicting rather than explaining the November futures prices is the initial goal. The objectives of this statistical analysis of the November futures price for soybeans are: (1) to predict the direction of the change in the November futures price from one year to the next, and (2) to predict the futures price as of November of that calendar year. Both predictions are based upon information available immediately prior to planting time.

V. REVIEW OF RELATED LITERATURE

Most of the past economic research on soybeans has emphasized aspects of production, marketing, processing, and exports. However, a number of statistical price analyses also have been conducted with varying degrees of success. Perhaps the first of the soybean price analysis studies was reported in a 1948 bulletin by E. G. Strand.[13] Consideration was given the costs and returns of soybeans relative to other crops and the market price relationships of the various crops, including soybeans, for the United States. The importance and potential of soybeans in the agricultural economy was summarized and estimates were made of future supply and demand conditions based upon potential expansion of oil and meal markets.

Another early study of soybean and soybean products prices was conducted by Don Paarlberg and published in 1949.[14] Variation in the prices of soybeans, oil, and meal were explained through the use of correlation analyses in terms of changes in prices and quantities of a number of related commodities and in the overall price level. Changes

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[13]E. G. Strand, Soybeans in American Farming, United States Department of Agriculture, Technical Bulletin No. 966 (Washington, D. C.: Government Printing Office, November, 1948).

[14]Don Paarlberg, Prices of Soybeans and Soybean Products, Purdue University Agricultural Experiment Station Bulletin No. 538 (Lafayette: Purdue University, September, 1949).

in the nature of the industry, particularly the increase in exports of soybeans and meal, were reported to have reduced the reliability of the computed estimates.

A few years later G. L. Jordan studied the relationships between oil and meal prices and the price of soybeans.[15] Price analyses were conducted on both soybean oil and meal. A linear regression function was used to estimate the crushing and handling margin from the combined value of the meal and oil per bushel of beans. In turn this estimate was used to predict the farm level of soybean prices. Two other publications[16] related the per bushel yield value of meal and oil directly to the price of soybeans at the farm.

A recent detailed statistical model of the United States soybean market has been constructed by James P. Houck. The main objective of his study "was to compute and analyze empirical estimates of the parameters in a simultaneous statistical model."[17] Eight important price-making factors were each represented by a linear equation and estimates

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[15]G. L. Jordan, What Determines Soybean Prices, University of Illinois Agricultural Experiment Station Bulletin No. 546 (Urbana: University of Illinois, March, 1951).

[16]Two similar studies are: Hiroshi Nakamura and Thomas A. Hieronymus, Structure of the Soybean Processing Industry, University of Illinois Agricultural Experiment Station Bulletin No. 706 (Urbana: University of Illinois, February, 1965); and Martin S. Simon, Soybeans: Economic Analyses Relating to Processing, United States Department of Agriculture Marketing Research Report No. 35 (Washington, D. C.: Government Printing Office, May, 1953), 30-34.

[17]James P. Houck, Demand and Price Analysis of the U. S. Soybean Market, University of Minnesota Agricultural Experiment Station Technical Bulletin No. 244 (Minneapolis: University of Minnesota, June, 1963).

were computed from least squares and two-stage least-squares procedures. The former method tended to predict more accurately than the latter when compared with actual data. The equations for the factors varied in fit from "extremely well" to "fairly good," with the estimates of quantity generally more accurate than estimated prices.[18]

The Commodity Exchange Authority in 1962 issued a report on the soybean futures market for the 1960-61 marketing season.[19] The market's unusual size and the occurrence of extensive price movement induced the study's undertaking. The report, in addition to pointing out the significant supply and demand factors affecting the market during the season, considered the importance of trading and positions of large speculators, in-and-out traders, and hedgers and small traders, on daily ranges in prices and price movements. While the extent of the range between the daily high and low was correlated with trading volume variations, and large traders were more of a factor than small traders in price movements, price advances and declines did not indicate a "runaway" market, nor were the hedging services of the market impaired.

The most recent study reviewed was an analysis of the soybean economy through an econometric analysis of prices and quantities demanded.[20]

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[18] Ibid., p. 54.

[19] Commodity Exchange Authority, Soybean Futures Market 1960-61, United States Department of Agriculture (Washington, D. C.: Government Printing Office, February, 1962).

[20] Roger J. Vandenborre, "Demand Analysis of the Markets for Soybean Oil and Soybean Meal," Journal of Farm Economics, XLVIII (November, 1966), 920-34.

A ten-equation simultaneous model was constructed, including twenty-two variables, representing quantities demanded domestically as well as exported. The estimates indicated that 30 million bushels would be the annual increase in soybean production necessary to meet national and export demand if prices are expected to remain relatively constant.[21]

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[21] Ibid., p. 920.

CHAPTER II

THEORETICAL FRAMEWORK

According to established economic theory, prices are determined by the interaction of supply and demand. Waugh has indicated that theory is merely an explanation and that while pure theory may be an end unto itself, the true test lies in whether it can "explain" certain activities in the real world.[1]

Though it is an easy oversight, there is no economic basis for considering a futures market different from a "spot" or local market. While the futures market may enjoy the distinguishing features of high volume of trading, the frequency of transactions, and the wide and immediate publicity given price quotations, the same economic forces govern price movement there as in the local market.[2] It is therefore useful to review these factors and their respective influences upon price movement.

I. COMPONENTS OF SUPPLY AND DEMAND

Supply

"Supply of a good is defined as the various quantities of the good which sellers will place on the market at all possible alternative prices,

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[1]Frederick V. Waugh, Demand and Price Analysis: Some Examples from Agriculture, United States Department of Agriculture, Technical Bulletin No. 1316 (Washington, D. C.: Government Printing Office, November, 1964), p. 1-2.

[2]Holbrook Working, "Futures Trading and Hedging," The American Review, XLIII (June, 1953), 320.

other things equal."[3] The total supply is composed of (1) inventory or supply on hand and (2) production.

A priori, the slope of the supply curve for most commodities is upward and to the right or positive. This is because at higher prices more sellers will be attracted into the market and greater quantities will be placed on the market.

Supply of Soybeans

The main supply of soybeans from one year to the next is from the farm, with comparatively small quantities in commercial storage carried over from year to year as normal inventories. The producer's decision of how many acres to plant to soybeans is based upon his evaluation of many factors. Included are expected prices of various crops and types of livestock, the combinations of crops and livestock he can produce, production costs for various enterprises, and the government programs intended to reduce the acreage planted to corn and cotton, and therefore increase acreage available for soybean production.

While no elasticity of supply figures were found for soybeans, it can be assumed that for a given marketing year, the supply curve would be more inelastic than a supply curve covering a number of years. The supply curve for a specific year is more inelastic, since once production decisions have been made and initiated, the costs of production

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[3]Richard H. Leftwich, The Price System and Resource Allocation (New York: Holt, Rinehart, and Winston, 1964), p. 30.

are sunk and cannot be recovered. On the other hand, producers are able to alter production plans from year to year, thus, the long-run supply curve for soybeans is less inelastic.

A decline or shift to the left in the soybean supply function for a given marketing year, t, would occur if farmers reduced soybean production in response to lower prices in the previous marketing year, t-1, greater advantage in producing a different crop, or their acceptance of an effective supply control program.

An increase or shift to the right of the supply function may be brought about by increased production resulting from favorable prices in the preceding marketing year, greater advantage in producing soybeans over other crops, the absence or ineffectiveness of government price support programs, or simply producer optimism.

Demand

A demand schedule has been defined as the quantities of a commodity that will be taken in the market at all possible prices, at a given time, while other factors remain unchanged. The price of a commodity influences the amount that consumers are willing to take. In general a higher price induces less to be demanded, while a lower price increases the amount taken. This is referred to as the law of downward-sloping demand curve.

Another important definition is that of derived demand. The demand for a commodity is considered a derived demand when it is composed of

the demands for final products.[4] The derived demand for a basic commodity ultimately originates with the consumer's demand for the final products, although persons between producer and ultimate consumer may temporarily influence this demand.

In addition to a number of factors affecting demand, the price of each of the competing or substitute commodities available is an important one. If the price of a substitute commodity were lower than an equivalent quantity of soybeans, then the substitute would be purchased. The reverse situation is also true. This holds only to the extent that one commodity substitutes perfectly for another. An imperfect substitute will be purchased only if the price ratio of the two commodities favors the less desirable commodity.

The buyers' tastes and preferences also influence the demand for a commodity. Tastes and preferences may change from time to time as is exemplified by consumers' current preference for beef over pork at the dinner table as their incomes rise, allowing them greater purchasing power.[5]

The number of buyers interested in a commodity has so direct a bearing on its demand as to be easily overlooked. The greater the number

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[4]Milton Freedman, Price Theory (Chicago: Aldine Publishing Company, 1965), p. 14.

[5]Harold F. Breimyer, Demand and Prices for Meat, United States Department of Agriculture, Technical Bulletin No. 1253 (Washington, D. C.: Government Printing Office, December, 1961), p. 1.

of buyers, given the quantity demanded per buyer remaining constant, the greater the total quantity of a commodity that is demanded at a given price.

The buyer's income is an important factor in that as incomes rise at a faster rate than the general price level, buyers are able to purchase greater quantities of commodities they desire than otherwise. This increases or shifts the demand curve for some commodities to the right and may shift demand curves for other commodities to the left.

In addition, demand may be influenced by the amount of effective promotional advertising and discovery of new uses.

Demand for Soybeans

The demand for soybeans is a complex one, with a large number of factors of varying importance contributing both directly and indirectly. The demand for soybean meal and oil are the two most important factors directly influencing the demand for soybeans and constitute an example of derived demand. Meal and oil are derived from the crushing and processing of a 60 pound bushel of soybeans in a relatively fixed proportion of approximately 11 pounds of oil, 48 pounds of meal, and 1 pound of moisture and unuseable material.[6]

As the demand for meal and/or oil increases above the normal levels of inventory, the demand for soybeans by processors increases in direct proportion. A decrease in the demand for meal and/or oil reduces directly

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[6]Houck, op. cit., p. 11.

the demand for soybeans.

The demand for soybeans at the farm level for farm use constitutes only a minor proportion of total demand. Approximately 5 percent of the crop is held on the farm for yearly seed requirements and a little over one million bushels are directly fed per season.[7]

The crushing margin is a major factor indirectly influencing the demand for soybeans. The crushing margin has been defined by Hieronymus as the spread between the value of the soybean products derived from a bushel of soybeans and the price paid per bushel of soybeans by the processor.[8] Narrow crushing margins tend to reduce the processors' demand for soybeans. However, while the crushing margins may appear to have been gradually declining in recent years, increased total volume of crushings and expanded use of futures markets have acted as counter-balances to margin reductions, such that the returns have tended to increase for the industry as a whole.[9]

Demand for Soybean Meal

In past years soybean meal has equalled and more recently surpassed soybean oil as the most important soybean demand influencing factor.[10]

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[7]Fred R. Lowell, Profits in Soybeans, (Kansas City, Missouri: Keltner Statistical Service, Inc., 1966), pp. 142, 199.

[8]Hieronymus and Nakamura, op. cit., p. 39.

[9]Ibid., p. 40.

[10]Houck, op. cit., p. 244.

The demand for soybean meal is composed of its uses primarily in the manufactured and farm-mixed livestock and poultry feeds industry, and to a lesser but expanding extent in the human foods industries. The demand for soybean meal for use in animal feeds, therefore, is directly related to the use of mixed feeds, numbers and prices of livestock and livestock products, and price and supply relationships among other competitive high-protein feed ingredients. It is more indirectly influenced by consumer disposable incomes, tastes and preferences among the various food products, and other influences.

Demand for Soybean Oil

Refiners demand crude soybean oil and in turn supply refined oil to manufacturers of shortening, margarine, salad dressing, and other oil-containing foods. Industrial users and the by-products of refining and degumming processes constitute further demand for soybean oil. The prices and quantities of other vegetable and animal fats and oils, disposable incomes, consumer tastes and preferences, government demand for oil to be used in relief programs, and changes in individual expectations, influence the demand for soybean oil.

An increase in demand by one of the factors, not counterbalanced by a corresponding decrease in another factor, brings about an increase in the total demand for soybeans. Conversely, a decrease in the demand for soybean oil brought about by a reduction in the use of margarine, for example, other factors remaining constant, reduces the demand for soybeans by processors.

Demand for Export

During recent years the amount of soybeans going for export has increased substantially. Exports now account for approximately 25 percent of total annual production.

The demand by exporters for soybeans is determined by such factors as the world population, prices of soybeans and competing oilseeds, oilseed meals, other vegetable and animal fats and oils, foreign consumers' disposable incomes, tastes and preferences, and expectations.

Exports are in three forms--soybeans, soybean oil, and soybean meal. While it is customarily cheaper to ship meal or oil because of its greater value per unit of weight and volume, soybeans remain the main form of export, since there is less possibility of quality deterioration and, more important, because many countries subsidize their national processing industries.

II. SUPPLY AND DEMAND COMPONENT CHANGES

Returning to basic theory, price is determined at the intersection of the supply and demand curves at a given period of time. The time period may be a year, a month, a fraction of a day, or any period designated. However, the factors that influence the supply and demand schedules are constantly changing. Even the change in the price itself may cause changes in the supply and demand schedules by influencing individuals expectations.

An attempt at describing a demand or supply curve statistically faces many difficulties. The point of intersection of a supply curve and a demand curve determines the price as measured by the height of the point above the x axis. This is representative of the situation at a given moment only, and situations change. If supply and demand conditions are changing, the point of intersection of the supply and demand curves is also shifting. The observations of points of intersection, therefore, reflect the changing conditions of the supply and demand schedules, rather than outline either the supply or demand curve as is the case if one curve remains stable.

Soybeans exemplify a commodity with changing conditions of both supply and demand schedules, making the statistical calculations for the fit of either a true demand or supply curve, at the least, difficult.

In addition to the changing conditions that surround the supply and demand factors, any alterations made upon the data may also contribute to artificially shifting or covering a shift of the statistically described schedule under study. Deflating a series of actual prices by different indices provides a dissimilar series of resulting prices.

However, recognizing the existence of these conditions which reduce the reliability of fitting a statistically derived schedule to the actual conditions must not be taken to indicate that any study is meaningless. E. J. Working has pointed out that at the very least the statistically fitted schedule may be relied upon in estimating price.[11]

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[11]E. J. Working, "What Do Statistical 'Demand Curves' Show?" Quarterly Journal of Economics, XLI (June, 1927), 227.

CHAPTER III

APPROACH TO THE PROBLEM

After reviewing the theoretical supply-demand relationship and the factors that comprise or influence it, a view of a commodity exchange and discussion with traders should help relate theory with reality. A trip was made to Chicago to conduct informal individual discussions with selected traders and view trading on the exchange.

I. A CLOSE VIEW OF THE MARKET

Perhaps the best way to understand the functioning of a commodity exchange is by observing the activity there, especially by being present on the trading floor during business hours and particularly during the opening minutes of trading.

Each business day begins precisely at 9:30 a.m. by the ringing of a large bell and is closed in the same fashion exactly at 1:15 p.m. No trading is permitted before or after trading hours. However, between the opening and closing hours trading is conducted at a noisy and feverish pace and with no noon lunch break.

The room in which trading is conducted is a spacious one, being a city block long and a quarter of a block wide, with the ceiling five stories above the floor. One long wall facing north contains windows running from floor to ceiling, allowing ample daylight into the room.

The actual trading must take place in seven pits of varying sizes, with the more active commodities traded in the larger pits. The pits are octagonal wooden platforms, with descending steps on the inside. Their shape permits all buyers and sellers to see all other traders within the pit. The pit is not separated into buyers and sellers, since any trader may be a buyer one moment and a seller the next. The traders stand in the pits, on steps or in groups according to the delivery month in which they are currently trading.

Buy and sell orders are placed by telephone, telegraph, and messengers with the floor traders[1] by an unlimited variety of customers. A brokerage firm's customers range from grain merchants and processors to housewives. In addition to completing customers' orders, some floor traders buy and sell for their own or their brokerage houses' account. Orders may be placed with a number of qualifications or restrictions as seen fit by the customer. Market orders, the most common, are executed immediately at the current market price. Notification of the customer at his brokerage firm, no matter where its location, within two minutes after placement, is not at all uncommon.

Upon receiving an order from a customer the floor trader indicates his willingness to buy or sell by loudly crying out his bid or offer and repeating it through hand and finger signals. After accepting an offer

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[1]Gerald Gold, Modern Commodity Futures Trading (New York: Commodity Research Bureau, Inc., 1966), p. 241. A floor trader is one who executes orders for others by being personally present in the pit of the exchange.

or gaining acceptance of a bid he records the transaction upon the appropriate side of his trading card. There he will jot down the number of contracts traded, the grain and delivery month, the name of the other firm and its broker's initials, and the price. At the close of the business day the trading cards become records of the clearing house, since they have been adjudged legal contracts by the United States Supreme Court.

The clearing house checks to see that all transactions agree with the opposites, then it becomes the "other party" in all the transactions. This enables buyers and sellers to deal directly with the clearing house, therefore, simplifying procedures. Otherwise, when a buyer decided to liquidate his contract, he would have to gain the agreement of the other party. Thus the clearing house enables a trader to offset his positions at his discretion. Should delivery of a contract be accepted or intended, the clearing house determines who will deliver and who will receive.

Perhaps the most important function of the clearing house is that it guarantees performance of all contracts. It is the clearing house that requires the original margin deposit and if necessary the variation margin from the brokerage house customer. Also the commodity exchange members contribute to a Guarantee Fund and are assessed fees that are used to guarantee fulfillment of each contract.

While the commodity exchange is a self-managed institution writing its own rules and regulations, the Commodity Exchange Authority has been organized to supervise and when necessary regulate trading in

certain commodities as provided by the Commodity Exchange Act.

An exchange must be licensed by the Commodity Exchange Authority before futures trading in regulated commodities is permitted. To qualify for a license the exchange must provide rules for the prevention of malpractices. It must also keep written records of all transactions as is done by the clearing house, minutes of board meetings, and other records so indicated to be retained.

Traders and brokerage houses must also register with the Authority. The agency audits the books of all registered brokerage firms to insure the prevention of fraud and false transactions, that no speculative positions are in excess of allowable limits, and that customers' funds are separated into individual customer accounts.

Limits set on speculative positions prevent price manipulation or cornering the market. These limits upon the number of contracts held vary with each commodity, but apply both to a single delivery month and to combined months.

The records kept by the clearing house provide the agency with such information as is requested and specific information upon customers whose position reaches a specified size.

II. DISCUSSIONS WITH TRADERS[2]

Supply-Demand Factors

Discussions with traders revealed no "special" factor to be most important in soybean futures price determination. The more important

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[2]Discussions with individual traders were informally held and with the understanding that references would remain anonymous.

factors they consider include estimates of production, carryover, soybean meal and oil demand, exports, and government programs. These factors are consistent with those considered theoretically. Most traders indicated that the theory of marketing and of supply and demand finds much support in futures trading. They further pointed out that foreign influences are also considered. Ceteris paribus, the supply of competitive commodities, for example, diminishes the export demand for soybeans, meal, and oil. While many foreign factors exert influence, a number either are not quantifiable or quantitative information is not available.

They indicated that the supply side of the picture is comparatively simple to develop, but beyond knowing that the demand curve is shifting upward and to the right, it is more difficult to anticipate the level of demand.

While recognizing the influence of government price support programs upon improving producers' incomes, traders contended that an established price support places a "floor" under market prices, thereby reducing the activity of a free market to trading that might take place above the support price.

Along with factors directly constituting supply or demand, other factors indirectly affect it. A trader mentioned, for example, that the number of livestock on feed indirectly influences the demand for soybeans through the direct demand for livestock feed, which in turn affects the demand for soybean meal.

Prices and supplies of competing commodities were also mentioned as influences. Cottonseed meal is a substitute for soybean meal and

therefore its price and supply influence the price of soybean meal and in turn of soybeans.

Another influence discussed was the effect of tariff rates upon exports. Higher tariff rates of an importing country reduce United State's exports of soybeans and therefore lower the amount demanded. High tariff rates were consistantly criticized by traders not only for the United States, but other free countries as well. Along with the free market system, free world trade was held in high regard by most traders.

In summation, the supply-demand factors considered from the theoretical standpoint to be influential in price determination are the same factors evaluated by the commodity traders in establishing a price.

Basis for Trading Evaluation

While it is difficult to determine to what degrees quantitative and nonquantitative information, and trading experience influence the total picture of price determination, no one of them is relied upon entirely. It appeared that though an econometric analysis may at times be successful, its present reliability may be overemphasized. One trader pointed out that while econometric analysis may be very successful periodically in predicting price, there are a number of factors that influence the market that can not be quantified.

Traders indicated that while much quantitative information is utilized and nonquantitative news is evaluated in light of past trading

experience, and comprises the most important substance of price determination, the "human factor" must also be recognized. By "human factor" is meant the noneconomic, other-encompassing, perhaps even emotional influence. For example, a dreary day combined with a trader bearing a less than cheerful outlook may together suppress his enthusiasm in the pit, thereby reducing his bidding or offering. Reduced trading, in turn, diminishes the continuity so highly valued in futures markets. On the other hand, while one trader may have a bad day, other traders of brighter outlook will tend to balance out the influence.

Traders utilize teletype services for news of market conditions and changes. Much of the information they receive may not bear directly or immediately upon the market, but may exert influence at a later time. Such information may bring a change in economic philosophy which, in turn, will have effect upon price-determining factors. This type of information may not be quantifiable, say the traders, but remains an important influence upon price determination.

Trading experience may at times be heavily relied upon. Market conditions or circumstances may repeat themselves in a fashion sufficiently similar to previous ones for an experienced trader to anticipate the direction of price changes and perhaps, to some degree, their magnitude.

Sources of Information

The sources of quantitative information available to and utilized by commodity traders are many. The situation reports and other periodic

reports available from the United States Department of Agriculture constitute the foundation of information upon which traders depend.

Supplementing this information a number of private reporting services have been established that provide timely information upon particular subjects of market interest. For example, two independent weather reporting services provide their respective subscribers with weather reports that are more detailed and local in nature than can be made available by the government weather reporting service. Further, a few private organizations have undertaken the reporting of basic supply-demand conditions at intervals between the periodic reports of the United States Department of Agriculture.

Teletype services provide information of the activities and conditions in other important markets throughout the world. Information included may not relate directly to one specific futures market, but may relate information about a competitive or complementary commodity which may, therefore, influence price movement.

Grain merchants, processors, and truckers are among the other sources of information that traders depend upon. Persons located close to the crop and the various sources of demand are able to provide current and localized information that is unavailable from sources reporting periodically. Commodity traders utilize each and every source of dependable information available and are continually searching for new and more current sources.

CHAPTER IV

ANALYSES OF NOVEMBER FUTURES PRICE

I. TIME PERIOD OF STUDY

The time period selected for the study was 1950 through 1965, sixteen consecutive years. Years before 1950 were not included for three particular reasons. First, the late 1930's and early 1940's were unstable economic times, with a recession in 1937 followed by World War II and its influence upon production and consumption. The economic instability is reflected in erratic price movements. Second, while the production of soybeans had been increasing gradually, and during the Second World War the demand for soybean products was expanded, during the five years following the war's end, the volume of soybean crush remained stable.[1] The third reason for the period selected for analysis was that continuous data series for certain of the variables considered were not available prior to 1950.

II. NOVEMBER FUTURES PRICE

The November futures have been selected over the other contract months since the November futures price reflects the first real interaction

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[1]Hiroshi Nakamura and Thomas Hieronymus, Structure of the Soybean Processing Industry, University of Illinois Agricultural Experiment Station Bulletin No. 706 (Urbana: University of Illinois, February, 1965), p. 5.

of the crop year's supply and anticipated demand. Prediction of a price range or even of the direction of change in the November futures price from the previous year's November price would greatly aid producers and processors in making economic decisions within their respective businesses.

III. PROCEDURE FOR OBTAINING NOVEMBER FUTURES PRICE

The average of the closing price for the five final days of trading the November future for soybeans is the foundation of this study. Microfilm recordings of daily issues of The Wall Street Journal, Chicago edition, served as the source of the data.

Upon reviewing previous price analysis research of the cash market for soybeans to determine the most important supply and demand factors, data of the factors selected for study were collected from various sources. Data limitations or unavailability also placed restraints upon the number of variables used in the analysis.

Simple linear regressions were run with each of the selected independent variables. The eight variables indicating the highest degrees of association and exhibiting regression coefficient signs consistent with economic theory were then used in various combinations in multiple regressions.

At the initiation of the study, both the actual and a deflated November futures price were used as dependent variables. A deflated November futures price was used in attempting to overcome the influences of inflation and changes in the general price level. Shepherd has pointed

out that no standard technique of price deflation is applicable to all problems.[2] While a number of studies have relied upon the general wholesale price index as their price deflator, its use has been questioned on the basis that agricultural commodity prices constitute only a small proportion of the total index. Nonagricultural commodity prices may be stable or increasing while agricultural commodity prices are declining, and the general wholesale price index will not reflect any decline. For this reason a wholesale price index of grains that is available from the Bureau of Labor Statistics was used as the deflator. While the soybean is an oilseed, not a grain, its overall price movements follow closely those of the grains, However, the results of the simple regressions with the deflated November futures price were consistently less satisfactory than those obtained by using the unadjusted price and thus were deleted.

The multiple linear regressions were run with various combinations of independent variables. Standard errors and t values were also found to determine whether the b values were significantly different from zero at the 95 percent level of confidence.

The equation chosen--the basis for the choice will be later discussed--was then used to predict the direction of price change from one year to the next, and to estimate the November price on the basis of information available at planting time.

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[2]Geoffrey S. Shepherd, Agricultural Price Analysis (Ames, Iowa: Iowa State University Press, 1963), pp. 121-131.

IV. VARIABLES CONSIDERED

Total supply, being composed of expected production and current inventory, is comparatively simple to analyze when compared with the multiplicity of variables that constitute or directly influence demand. The important measurable variables of demand have been evaluated in one or another of the studies presented in the above review of related literature. An exhaustive study of all those possible variables is not feasible here, so those considered most important on the basis of the r^2 values and economic theory have been used.

Actual Production Relative to the March Estimate

The United States Department of Agriculture presents an early estimate of soybean production each year in the March issue of Crop Production. It is based upon data compiled by the Statistical Reporting Service of March the first planting intentions reported by a sample of soybean producers throughout the United States. Once an estimate of the acres intended to be planted to soybeans has been obtained, a trend value of yield is used as multiplier and the March estimate of production is obtained.

The March estimates have, in general, provided a good indication of soybean production for the coming year. Differences between the actual production and the estimate made in March have ranged from as high as 80 million bushels to as close as 1 million bushels for the 19 years, 1948-1966, considered. The estimates have fallen short of the actual

production 15 of the 19 years, with an average difference of 35.5 million bushels. A linear regression of actual production with the estimate of March yielded an r^2 of .97* and a standard error of estimate of 40.7 million bushels.

March Estimate of Production

The March estimate of production, being the first estimate of the size of the soybean crop, made even before the acreage is planted, provides the best available estimate of the forth-coming crop. The importance of this early estimate is that it provides an indication of the expected supply for the approaching marketing year. An early indication of a small crop acts as a warning to the market that if supplies are to be available for the entire year, higher prices are necessary in order to ration out the smaller supply over the marketing year to those possessing the greatest demand.

The r^2 for the March estimate of production upon November contract[3] price was .11. The sign of the b value was negative, consistent with the expectation that the relationship between production and contract price is inverse.

Soybean Stocks on April the First

Stocks of soybeans in all locations on April the first, reported by the Statistical Reporting Service, provide an inventory of soybeans

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*Significant at the 95 percent level of confidence.

[3]The terms "November futures" and "November contract" are herein used interchangeably.

remaining to be utilized or carried over into the next crop year. Theoretically, an April the first stock figure is negatively associated with the November futures price. Likewise, the soybean crop and the November futures price are negatively associated. When stocks in all locations on April the first and the soybean crop are combined, their influence upon the November future price will tend to continue the negative relationship, though they may counterbalance each other as one is high and the other low or vice versa.

The linear regression of April the first stocks in all locations on November futures price yielded an r^2 of .21, fourth highest r^2 obtained in running simple linear regressions of independent variables upon November futures price. The b value exhibited a negative sign as could be expected since as the level of stocks increases, the total supply available in November would also increase and therefore force the November futures price downward.

Total Estimated Supply

The total estimated supply consists of the March estimate of soybean production for the year and the soybean stocks in all locations on April the first. Provided demand is stable, the relationship between total estimated supply and November contract price is inverse.

The coefficient of determination for this simple regression was .14, with the b coefficient exhibiting a negative sign as expected on the basis of economic theory.

February Price of Soybean Meal

The demand for soybean meal has become the outstanding force behind the demand for soybeans. The average price of soybean meal in February reflects the interaction of supply and demand for that commodity; it may be considered a partial and early indicator of expected demand for soybeans in November.

The regression of February soybean meal price upon the November contract price produced a .45* r^2 value, the highest simple regression r^2 obtained in this study. The regression coefficient was positive, indicating increases in meal price tend to be associated with increases in the price for soybeans.

February Price of Soybean Oil

The second component of the derived demand for soybeans is the demand for soybean oil. Though growth in the demand for soybean oil has not been as rapid in recent years as for soybean meal, it remains an important factor. Soybean oil remains a strong competitor for use by manufacturers of cooking oil, margarine, salad dressings, and other oil-containing foods and to a lesser extent by industrial users. The average price of soybean oil in February also acts as a partial indicator of the anticipated demand for soybeans in November.

The analysis provided an r^2 of .12 and a positive regression coefficient indicating a direct association between oil price changes and changes in the November futures prices.

Soybean and Soybean Equivalent Exports

Soybean and soybean equivalent exports are a factor, since soybean exports have in recent years become the second largest category of soybean utilization.[4] During the 1950-51 marketing year about 10 percent of the crop was exported, while in the 1964-65 year this figure reached approximately 30 percent. Soybean and soybean equivalent exports for the most recently past months of October through February were used as a variable, since they gave some advance indication of expected exports during the following November.

While soybeans, exported as beans, still comprise the major form of export, soybean meal and oil exports are substantial. Much of the oil exported passes under Public Law 480 which provides for the donation of surplus supplies to countries in need. Foreign industries also utilize the oil in the production and processing of edible fats and oils for such food items as margarine, cooking oil, and salad dressing.

Soybean meal is being exported in ever increasing quantities as livestock producers, particularly European, feed greater quantities of high-protein concentrates to livestock and poultry in response to the greater demand created by rising disposable incomes and standards of living.

The r^2 value for the simple regression was .14. The sign of the simple regression coefficient was negative and therefore inconsistent

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[4]Fred R. Lowell, Profits in Soybeans (Kansas City, Missouri: Keltner Statistical Service, 1966), p. 210.

with theory. Since exports constitute a portion of the total demand for soybeans, a positive relationship between exports and November contract price might be expected.

Index Numbers of Prices Received for Livestock and Livestock Products

The index number of prices received by farmers for livestock and livestock products during February was used as an early indication of the level of prices farmers could be expected to receive for the given crop year. Higher prices for livestock and livestock products have been associated with higher prices for soybean meal, and therefore for soybeans. Lower prices for livestock and products tend to have a lowering influence upon prices for soybean meal and soybeans.

A simple regression analysis yielded a .28* coefficient of determination, the third highest r^2 of the simple regressions.

The sign of the b coefficient was positive as would be expected, indicating the positive relationship between the direction of livestock and livestock products prices and the price of soybeans.

High-Protein-Consuming Animal Units

With the demand for soybean meal the primary component in the total demand for soybeans, high-protein-consuming animal units should provide some measure of the expected demand for meal and in turn for soybeans. High-protein-consuming animal units are reported for the feeding year of October 1 through September 30 which is also the reported marketing year for soybeans, and therefore should be an influence upon the November contract price.

The first of two approaches was to use, t-1, the previous livestock feeding year's consuming animal units as a measure of the reduction in the total supply of soybeans to be carried over into the following crop year, t. The influence of consuming animal units upon November contract price was practically negligible, with an r^2 value of .01. The negative sign of the regression coefficient appears inconsistent with the economic theory as presented by Foote,[5] specifically that if numbers of consuming animal units on farms are small, the demand for feed is small and with the relatively fixed short run supply of feed, the price of feed tends to be comparatively low.

The second approach was to use the number of high-protein-consuming animal units of the feeding year, t, concurrently with the crop year, t, of the November contract. The number of high-protein-consuming animal units was considered a good measure of the demand for soybean meal, and in turn, of the demand for soybeans.

The analysis provided an r^2 of .07, a higher coefficient of determination than resulted from the first approach, but still not a really important measure. The regression coefficient was again negative, inconsistent with established theory.

Grain-Consuming-Animal Units

The reasoning behind using grain-consuming animal units as a factor is essentially the same as for using high-protein-consuming

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[5]Richard J. Foote, Statistical Analyses Relating to the Livestock-Feed Economy, United States Department of Agriculture, Technical Bulletin No. 1070 (Washington, D. C.: Government Printing Office, June, 1953), p. 4.

animal units. They act as a measure of the demand for soybean meal which is a substantial factor in the demand for soybeans.

Grain-consuming-animal units as a category is more general than high-protein-consuming animal units and is also the source from which the latter is estimated. Similar tests for usefulness were made with this variable as with high-protein-consuming animal units and with almost identical results.

Preceding Year's November Futures Price

The final variable investigated was the preceding year's November contract price. While it may not be economically sound to attempt to explain one year's price by the preceding one, it is a means of determining if there exists a statistical relationship between the prices of two consecutive years.

The coefficient of determination was .40,* the second highest simple r^2. The sign of the b value was positive, indicating a direct relationship of the preceding year's price upon the current November futures price.

V. MULTIPLE REGRESSION EQUATIONS

Using the results of the investigations of the relationship between each of the independent variables discussed above and the November futures price, multiple regression techniques were applied to different combinations of variables. These combinations and their resulting estimates of November

soybean futures prices are discussed below. The b values, their standard errors, and t values have been rounded to the fourth place to the right of the decimal point, while the R^2 values and standard errors of estimate have been rounded to the second digit after the point. Five multiple regression equations were calculated and follow:

I. $X_1 = -40.8460 - 0.2468\ X_2 + 2.5672\ X_5 + 0.6632\ X_7$

Standard error	(0.0663)	(0.5235)	(2.0441)
t value	(3.7182)**	(4.9039)**	(0.3244)

$R^2 = .66$**

Standard error of estimate = 20.48

II. $X_1 = -54.6526 - 0.1209\ X_3 + 2.0212\ X_5 + 1.2730\ X_6$

Standard error	(0.0668)	(0.1665)	(2.0562)
t value	(1.8094)	(12.1396)**	(0.6191)

$R^2 = .65$**

Standard error of estimate = 20.60

III. $X_1 = -26.1223 - 0.1502\ X_4 + 2.2957\ X_5 + 0.5672\ X_7$

Standard error	(0.0941)	(0.5271)	(0.5305)
t value	(1.5961)	(4.3553)**	(1.0692)

$R^2 = .67$**

Standard error of estimate = 20.07

**Significant at the 99 percent level of confidence.

IV. $X_1 = -25.4676 - 0.1489\ X_4 + 2.2649\ X_5 + 0.5632\ X_7 + 0.0130\ X_9$

Standard error	(0.1042)	(0.8177)	(0.5605)	(0.2628)
t value	(1.4295)	(2.7698)**	(1.0049)	(0.0496)

$R^2 = .67$**

Standard error of estimate = 20.98

V. $X_1 = -51.9148 - 0.1500\ X_4 + 2.1508\ X_5 + 0.6044\ X_7 + 0.1211\ X_8$

Standard error	(0.0979)	(0.5945)	(0.5408)	(0.2194)
t value	(1.5321)	(3.6176)**	(1.1177)	(0.5519)

$R^2 = .68$**

Standard error of estimate = 20.29

where:

X_1 = November futures price, cents per bushel, year t

X_2 = March estimate of production, million bushels, year t

X_3 = Stocks in all locations on April the first, million bushels, year t

X_4 = Projected total supply of soybeans, million bushels, year t

X_5 = Soybean meal price, dollars per bulk ton, Decatur, average for February, year t

X_6 = Soybean oil price, cents per crude pound, tank cars at Decatur, average for February, year t

X_7 = Soybean and soybean equivalent exports, million bushels, October-February, year t-1 to year t

X_8 = Index numbers of prices received for livestock and livestock products, February 15th, year t

X_9 = Preceding year's November futures price, cents per bushel, year t-1.

Equation I

The March estimates of production, meal price, and exports were regressed upon the November futures price. In this equation the March estimate of production represents the supply side with meal price and exports representing the leading demand factors.

Ceteris paribus, the regression coefficient for the March estimate of production shows that the November futures price will vary inversely by approximately 25 cents with each one-hundred-million bushel change in the March estimate of production. The November futures price would react directly to each $10 a ton change in soybean meal price by about 26 cents, ceteris paribus. A change in the export of soybeans and equivalents of each one-hundred-million bushels results in a direct change in the November futures price of about 66 cents, while other factors are held constant.

The analysis provided a coefficient of multiple determination of .66, with a standard error of regression estimate of 20.48 cents.

Equation II

Stocks of soybeans in all positions on April the first and soybean meal and oil prices comprise the independent variables of the second analysis. April the first stocks in all positions provide a measure of the inventory of soybeans, while the prices of meal and oil are indications of the respective demands for the two products from which much of the demand for soybeans is derived.

The regression coefficient for stocks in all positions on April the first exhibits a negative sign consistent with economic theory, in that, as supplies increase, price decreases. The regression coefficient indicates that for a one-hundred-million bushel change in stocks, ceteris paribus, the November futures price would change in the opposite direction by approximately 12 cents. Other factors held constant, the regression coefficient for the soybean meal price shows a positive relationship indicating that for each 10-dollar change in the meal price, the price of the November contract changes in the same direction by 20 cents. The soybean oil price regression coefficient indicates that for each 10-cent change in the oil price, ceteris paribus, there is a change in the November futures price of approximately 13 cents in the same direction.

The coefficient of multiple determination was .65 and the standard error of the multiple regression estimate was 20.60 cents per bushel.

Equation III

Projected total supply, meal price, and exports was the combination of independent variables in the third equation representing both supply and demand.

The projected total supply regression coefficient shows an inverse relationship between projected total supply and the price of the November futures; as supply changes by one-hundred-million bushels, ceteris paribus, the November contract price changes in the reverse direction by about 15 cents. A change in the soybean meal price of $10 per ton induces a

change in the same direction of the November futures price by about 23 cents, other variables held constant. The November futures price varies directly by approximately 57 cents per bushel with a change in the export of soybean and equivalents of one-hundred-million bushels, ceteris paribus.

The coefficient of multiple determination was found to be .67 and the standard error of estimate for multiple regression was 20.07 cents per bushel.

This equation was used to predict both the price of the November contract and the direction of the price from the preceding year's contract price for the years 1966 and 1967. These results and discussion will be presented later.

Two additional variables were added independently to the combination of projected total supply, meal price, and export of soybeans and soybean equivalents of meal and oil to determine if they enhanced the R^2, reduced the standard errors, and increased the significance of the b values.

Equation IV

The combination of the four independent variables, projected total supply, meal price, exports of soybeans and soybean equivalents of meal and oil, and the preceding year's November contract price comprise the fourth equation.

The coefficient of multiple determination was .67 and the standard error of multiple regression estimate was 20.98 cents per bushel. Adding

the preceding year's November futures price contributed little to improving the coefficient of determination beyond the value obtained with the three independent variables. The standard error of multiple regression was increased with the variables addition by about one cent per bushel.[6]

Equation V

The index numbers of prices received by farmers for livestock and livestock products variable were added to the three other independent variables, projected total supply, meal price, exports of soybeans and soybean equivalents of meal and oil.

The analysis produced a coefficient of multiple determination value of .68 and a standard error of multiple regression estimate of 20.29 cents. Including a fourth independent variable added one percentage point to the coefficient of determination and increased the regression estimate standard error by about .3 of a cent.

VI. COMPARISON OF REGRESSION EQUATIONS

Each of the five equations contained one supply factor, either the March estimate of production, stocks in all positions on the first of April, or projected total supply, and the remaining independent variables represented demand, either directly as a demand influencing factor or as a measure of the influence of demand.

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[6]It is appropriate to indicate that while the standard errors have been corrected for degrees of freedom, the R^2's have not been so corrected.

Equations three, four, and five exhibited slightly higher R^2 values than the first two, perhaps because of the projected total supply, soybean meal price, and soybean and soybean equivalent exports variable combination. The additions of the prior year's November futures price and index number of prices received for livestock and livestock products to equations four and five, respectively, increased the standard error of estimate over that of equation three, the three independent variable equation. The addition of the index number of prices received for livestock and livestock products to equation three added approximately 1 percentage point to the R^2 value.

The highest R^2 value, .68, was obtained with projected total supply, soybean meal price, soybean and soybean equivalent exports, and index numbers of prices received from livestock and livestock products as independent variables in equation five. The R^2 values ranged from .65 to .68.

The lowest standard error of estimate, 20.07 cents per bushel, was found with equation three, standing lowest in a range of from 20.07 to 20.98 cents.

Only the March estimate of production and soybean meal price variables exhibited standard errors indicating significance of regression coefficients, both at the 99 percent level of confidence. However, regression coefficient signs without exception are consistent with the theoretical basis upon which their inclusion was founded.

VII. THE ESTIMATES

It was difficult to choose from among the five equations the equation with which to make the estimates. The R^2's, standard errors of estimate, and the significance of the b values all displayed little variation among the equations. The selection, therefore, was an arbitrary one. Equation III, composed of projected total supply, soybean meal price, and exports of soybeans and soybean equivalents of meal and oil as independent variables, was used in estimating the November futures price and direction of change in the November contract price from that of the previous year.

Inserting 1966 and 1967 data into this equation and solving, the November futures prices were predicted for both years. The estimated price for 1966 was $2.95, while the actual price was $3.03, an underestimate of eight cents; the 1967 estimated price was $2.63, exactly the actual price.

As for the direction of the November futures price from one year to the next, from 1965 to 1966 the price moved upward. From November 1966 to November 1967 the actual price moved downward. The direction of the estimated November price from 1966 and 1967 from the previous year's price was also upward and downward, respectively.

CHAPTER V

SUMMARY AND CONCLUSIONS

I. SUMMARY

The economic importance of soybeans not only to producers but also to processors, exporters, merchants, and ultimately the consumer has increased rapidly, making them the second most important cash crop produced in the United States. The contribution made by soybeans to the entire economy is not likely to diminish in the foreseen future; rather, their importance can be expected to expand as the demand for soybean products continues to increase and new uses are found.

From producer to consumer, prices play an important role. Producers and other businessmen dependent in one way or another upon the soybean, need a more accurate and timely knowledge of prices and greater stability or price in order to conduct their current businesses more efficiently and improve long-range planning. Consumers also benefit in that businesses serving them are able to offer a more stable supply of goods and at more stable prices.

The two basic objectives of this study were: (1) to predict the direction of the November contract price from the prior year's price, and (2) to predict the November futures price for that year. The predictions were made from information available at the time the soybean crop would be planted.

After reviewing the theoretical aspects of the supply-demand factors pertinent to a price study of the soybean futures, a trip was taken to Chicago and the Board of Trade. Informal discussions were conducted individually with selected commodity traders and centered around the factors they considered most important in evaluating the supply-demand situation of soybeans.

Important factors discussed were estimated production and anticipating the demand for soybean oil and especially soybean meal, since they are the reasons for the demand for soybeans. The export of soybeans and soybean products was another factor of importance, since exports are yearly becoming a greater proportion of the demand for the crop. Their sources of supply-demand information are primarily and most reliably the United States Department of Agriculture reports, though they are supplemented by private reporting services and individuals within the industry.

In addition to discussions of important supply-demand factors, sources of information, traders emphasized that the "human factor" in the market can not be overlooked. Human attitudes, not based upon economic information, may influence the movement of prices. Though not a major force behind price movement, this factor does exist and must be recognized.

On the basis of discussions with various traders, the theoretical framework of supply and demand, and previous price analyses of the cash

market for soybeans, nine supply-demand representative variables were selected. Data availability also placed limitations upon the variables analyzed.

Simple regression analyses of various selected independent variables were run against the November futures price. The variables yielding favorable r^2's and consistent in analysis with established economic theory were then used in multiple regression analysis.

Five multiple regression equations were constructed, using various combinations of the independent variables. The R^2's, standard errors of estimate and b values, t values, and levels of significance were determined. Interestingly, differences among the five equations were slight, with R^2's ranging from .65 to .68 and standard errors of estimates varying from 20.06 to 20.98. Only two b values were significant, those of March estimate of production and February soybean meal price variables.

The regression equation used in making the estimates was selected arbitrarily. It included the following independent variables: projected total supply, that is, March estimate of production and soybean stocks in all locations on the first of April, February price of soybean meal, and October through February exports of soybeans and soybean equivalents of meal and oil. The coefficient of multiple determination was .67 and the standard error of estimate was 20.07 cents. Of the b values, only that of the meal price was significant.

The equation did rather well in its predicting capabilities for 1966 and 1967. In estimating the direction of the November contract price

for one year to the next, both 1966 and 1967, price direction changes were correctly estimated. For 1966 the estimated price deviated from the actual by only eight cents. The 1967 estimate of the November futures price was exactly the actual price of that year.

II. CONCLUSIONS

While estimates of price and direction of price change made from information available approximately seven months in advance of the determination of the actual price would have been reasonably successful in 1966 and 1967, caution must be preserved. From a coefficient of multiple determination of .67, it may be inferred that more price variation could be explained by the effect of variables not included in the analysis. No doubt some of the unexplained variation can be attributed to the "human factor" on the market as traders have referred to it. Such human attitudes as pessimism and optimism presently are not quantifiable; the degree of their influence upon price movement is not known, only that the effect is present.

Another influence is that of the span of time between when the estimate is made and the actual period of price determination. During seven months, many factors can alter either supply or demand or both, that can not be anticipated sufficiently far in advance when making the estimations. The variables are useful only to the extent that they reflect a trend that will be continued into the November contract month.

III. SUGGESTIONS FOR FURTHER STUDY

The first suggestion to consider in further study would be the specifications of the model. Perhaps merely the addition of other variables would inhance the predictive capacity of the present multiple linear regression model. One approach is to present the data as ratios or percentages of some prior year's data or other standard. Another specification might be to express certain series as ratios of their trend values. The alternatives are many, but the logic behind the choice of one approach over another in a given study is difficult to establish.

As mentioned, additional variables could be analyzed. The variables utilized in this study should not be construed as the only important ones representative of the supply and demand forces. With the increasing demand for soybeans, the forces influencing demand need particular emphasis.

The above-referred-to human influence upon price movement is much in need of evaluation. The nonquantifiable, but qualitative, nebulous reasons that individuals buy and sell at various prices need, if nothing else, to be better explained. Any evaluation would be beneficial; nonquantifiable variables have been almost entirely ignored.

It has also been suggested that the entire futures price study might be better directed if, rather than considering the supply-demand factors for soybeans, the factors behind individuals' interest in and demand for futures contracts as contracts were analyzed. Certainly most

speculators have no interest in soybeans as such, but instead are interested in the contracts as investments with potentially high profits. What motivates them to buy or sell?

During the Chicago visit, traders suggested aspects of futures markets and prices that they considered deserving of further research. Two suggestions came up repeatedly.

The first suggestion is not a subject for research, but received considerable emphasis. It is that greater attention should be given to informing producers of the benefits available to them from hedging. A commodity exchange provides the opportunity for merchants, processors, and manufacturers among others to hedge and, therefore, reduce the possibility of their respective businesses being adversely affected by price movements. Producers frequently bear a rish much greater than any of the above, during the time that the crop is being produced; however, few producers take advantage of or are aware of the process of hedging.

The other suggestion is a need for state or regional studies of the factors responsible for and the price relationships between futures markets and local markets. Both producers and others involved would benefit from an improved understanding of such relationships.

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APPENDICES

APPENDIX A

TABLE I

ESTIMATED AND ACTUAL PRODUCTION OF SOYBEANS AND TOTAL STOCKS OF SOYBEANS IN ALL LOCATIONS ON APRIL THE FIRST, UNITED STATES, 1950-1967

Year	Soybean Production		April the First
	Estimated[a]	Actual[b]	Total Stocks[c]
	1,000,000 bushels		
1950	228	299	122
1951	233	284	143
1952	272	299	130
1953	285	269	147
1954	340	341	118
1955	375	374	175
1956	410	449	177
1957	430	483	215
1958	460	580	254
1959	475	533	323
1960	539	555	310
1961	600	680	265
1962	668	669	359
1963	725	699	344
1964	756	702	378
1965	829	844	347

TABLE I (CONTINUED)

Year	Soybean Production		April the First
	Estimated[a]	Actual[b]	Total Stocks[c]
	1,000,000 bushels		
1966	882	928	376
1967	1000	973	460

[a]Obtained by letter from Mr. Thomas B. Smith, Agricultural Economist, Marketing Economics Division, Economic Research Service, United States Department of Agriculture, Washington, D. C., June 30, 1967; and Statistical Reporting Service, Crop Production: Prospective Plantings United States Department of Agriculture (Washington, D. C.: Government Printing Office, March, 1967), p. 2.

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[c]Fred R. Lowell, Profits in Soybeans (Kansas City, Missouri: Keltner Statistical Service, Inc., November, 1966), p. 147; "In the Markets," Soybean Digest, XXVI (May, 1966), 99; and "In the Markets," Soybean Digest, XXVII (May, 1967), 90.

TABLE II

WHOLESALE PRICES OF SOYBEAN MEAL AND OIL AT DECATUR, ILLINOIS, AND INDEX NUMBERS OF PRICES RECEIVED BY FARMERS FOR LIVESTOCK AND LIVESTOCK PRODUCTS, UNITED STATES, FEBRUARY, 1950-1967

Year	Soybean Meal Average Price per Bulk Ton, 44% Protein[a]	Soybean Oil Average Price, Crude, F. O. B. Tank Car Lots[b]	Livestock and Livestock Products Index of Prices Received by Farmers[c] 1910-14 = 100
	$ per ton	¢ per pound	
1950	56.45	11.4	259
1951	69.25	21.1	342
1952	74.00	10.7	318
1953	64.90	12.6	273
1954	77.10	12.5	269
1955	65.60	12.2	241
1956	49.40	12.8	219
1957	46.90	14.0	230
1958	46.90	11.4	269
1959	54.75	9.3	266
1960	57.50	7.6	247
1961	61.50	12.2	263
1962	57.60	10.2	258
1963	73.10	9.2	252
1964	74.80	8.0	239
1965	69.80	12.1	240

TABLE II (CONTINUED)

Year	Soybean Meal Average Price per Bulk Ton, 44% Protein[a]	Soybean Oil Average Price, Crude, F. O. B. Tank Car Lots[b]	Livestock and Livestock Products Index of Prices Received by Farmers[c] 1910-14 = 100
	$ per ton	¢ per pound	
1966	77.30	12.0	302
1967	79.50	10.3	277

[a]Economic Research Service, Grain and Feed Statistics, Through 1961, United States Department of Agriculture, Statistical Bulletin No. 159 (Washington, D. C.: Government Printing Office, Revised June, 1962), p. 88; Economic Research Service, Feed Statistics, Through 1966, United States Department of Agriculture, Statistical Bulletin No. 410 (Washington, D. C.: Government Printing Office, September, 1967), p. 87; and Economic Research Service, Feed Situation, United States Department of Agriculture (Washington, D. C.: Government Printing Office, April, 1967), p. 2.

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TABLE III

YIELD PER BUSHEL OF SOYBEANS CRUSHED AND EXPORTS OF SOYBEAN OIL AND MEAL, UNITED STATES, OCTOBER THROUGH FEBRUARY, 1949-1966

Crop Year Beginning October	Soybean Oil		Soybean Meal	
	Yield per Bushels of Soybeans Crushed[a]	Exports[b]	Yield per Bushel of Soybeans Crushed[a]	Exports[c]
	Pounds	Mil. lbs.	Pounds	Thou. short tons
1949	9.9	121	46.9	15.7
1950	9.7	127	46.8	45.8
1951	10.0	147	47.6	30.4
1952	10.8	57	47.3	9.0
1953	11.0	31	47.4	44.6
1954	10.9	18	45.9	146.9
1955	11.1	190	46.2	219.1
1956	10.9	401	47.5	258.6
1957	10.8	166	46.8	153.8
1958	10.6	264	47.3	243.7
1959	11.0	212	46.5	373.2
1960	11.0	350	47.0	287.0
1961	10.9	341	47.2	463.7
1962	10.7	309	46.9	578.3
1963	10.9	344	48.0	581.3
1964	10.9	530	47.8	846.9
1965	10.8	405	47.5	1324.6
1966	10.9	351	47.5	1179.0

[a]Economic Research Service, United States Fats and Oils Statistics, 1909-65, United States Department of Agriculture, Statistical Bulletin No. 376 (Washington, D. C.: Government Printing Office, August, 1966), p. 72; and Economic Research Service, Fats and Oils Situation, United States Department of Agriculture (Washington, D. C.: Government Printing Office, January, 1967), p. 30.

TABLE III (CONTINUED)

[b]Agricultural Marketing Service, Oilseeds, Fats and Oils, and Their Products, 1909-53, United States Department of Agriculture, Statistical Bulletin No. 147 (Washington, D. C.: Government Printing Office, June, 1954), p. 175; Economic Research Service, United States Fats and Oils Statistics, 1909-65, United States Department of Agriculture, Statistical Bulletin No. 376 (Washington, D. C.: Government Printing Office, August, 1966), p. 79; and Economic Research Service, Fats and Oils Situation, United States Department of Agriculture (Washington, D. C.: Government Printing Office, June, 1967), p. 9.

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TABLE IV

EXPORTS OF SOYBEANS AND BEAN EQUIVALENTS OF SOYBEAN OIL AND MEAL, UNITED STATES, OCTOBER THROUGH FEBRUARY, 1949-1966

Crop Year Beginning October	Exports in Soybean Equivalents		Exports of Soybeans[b]	Total
	Soybean Oil[a]	Soybean Meal[a]		
	Million bushels			
1949	12.2	0.7	9.0	21.9
1950	13.1	2.0	14.1	29.2
1951	14.7	1.3	10.8	26.8
1952	5.3	0.4	19.6	25.3
1953	2.8	1.9	29.8	34.5
1954	1.7	6.4	36.6	44.7
1955	17.1	9.5	44.1	70.7
1956	36.8	10.9	48.6	96.3
1957	15.4	6.6	50.3	72.3
1958	24.9	10.3	55.8	91.0
1959	19.3	16.1	68.6	104.0
1960	31.8	12.2	76.7	120.7
1961	31.3	19.6	82.0	132.9
1962	28.9	24.7	91.5	145.1
1963	31.6	24.2	96.1	151.9
1964	48.6	35.4	95.5	179.5
1965	37.9	55.8	139.8	233.5
1966	32.8	49.6	139.8	222.2

[a]Derived from data presented in Table III.

[b]Economic Research Service, United States Fats and Oils Statistics, 1909-1965, United States Department of Agriculture, Statistical Bulletin No. 376 (Washington, D. C.: Government Printing Office, August, 1966), p. 73; and Economic Research Service, Fats and Oils Situation, United States Department of Agriculture (Washington, D. C.: Government Printing Office, June, 1967), p. 7.

TABLE V

ANIMAL UNITS AVAILABLE AS POTENTIAL SOYBEAN MEAL CONSUMERS, BY CROP YEARS, UNITED STATES, 1949-1967[a]

Year Beginning October 1	Consuming Animal Units	
	Grain	High Protein
	---------1,000,000 units----------	
1949	164	134
1950	168	136
1951	167	137
1952	159	134
1953	157	134
1954	162	135
1955	165	138
1956	161	137
1957	160	136
1958	168	141
1959	166	140
1960	168	143
1961	169	144
1962	173	147
1963	173	149
1964	169	148
1965	170	151
1966	178	158
1967	177	157

[a]Rounded to the nearest 1,000,000 units from data presented in Economic Research Service, Livestock-Feed Relationships, 1909-1963, United States Department of Agriculture, Statistical Bulletin No. 337, (Washington, D. C.: Government Printing Office, November, 1963), pp. 19 and 39; and Economic Research Service, Supplement for 1967, Livestock-Feed Relationships, 1909-1963, United States Department of Agriculture, Supplement to Statistical Bulletin No. 337 (Washington, D. C.: Government Printing Office, November, 1967), pp. 8 and 24.

APPENDIX B

TABLE VI

COMPARISON OF ACTUAL WITH ESTIMATED NOVEMBER FUTURES PRICE FOR SOYBEANS AND ACTUAL WITH ESTIMATED YEARLY DIRECTIONAL CHANGE IN NOVEMBER FUTURES PRICE FOR SOYBEANS, CHICAGO BOARD OF TRADE, 1950-1967

Year	November Futures Price			Direction of Price Change[c]	
	Actual[a]	Computed[b]	Difference	Actual to Actual	Actual to Estimate
1950	2.92	2.63	.29		
1951	3.02	2.93	.09	+	+
1952	3.00	2.99	.01	--	-
1953	2.91	2.72	.19	-	-
1954	2.80	3.02	-.22	-	+
1955	2.34	2.67	-.33	-	-
1956	2.53	2.39	.14	+	+
1957	2.28	2.39	-.11	-	-
1958	2.13	2.15	-.02	-	-
1959	2.21	2.31	-.10	+	+
1960	2.13	2.37	-.24	-	+
1961	2.42	2.54	-.12	+	+
1962	2.45	2.27	.18	+	-
1963	2.78	2.64	.14	+	+
1964	2.78	2.61	.17	N. C.	-
1965	2.54	2.59	-.05	-	-
1966	3.03	2.95	.08	+	+
1967	2.63	2.63	.00	-	-

[a]Average closing price of the November futures for the five final days the contract was traded. The closing price for each of the five final days of trading for each year was taken from the "Commodities" page of selected appropriate issues of The Wall Street Journal [Chicago Edition].

[b]Computed from equation III.

[c]Positive sign (+) indicates an upward direction, a negative sign (-) indicates a downward direction, and N. C. indicates no change in the direction of price change.